CLAIMS

We claim:

1. A method for increasing the rise time of air bubbles emitted from a diffuser in water for the purpose of suppressing noise in a marine seismic survey, said method comprising the step of coating the diffuser before use with a chemical additive having bubble coalescence retardation properties or wetting agent properties or both.

2. The method of claim 1, wherein the chemical additive is Exxal-13 diluted in ethanol.

3. The method of claim 1, wherein the chemical additive is chosen from among the following: 2-ethyl-1-hexanol, octanol, Exxal-8, Exxal-9, Exxal-13, and sodium dodecyl sulfate.

4. The method of claim 1, wherein the chemical additive is a poly(oxyalkylene) block copolymer composed of ethylene oxide (EO) and propylene oxide (PO) blocks having any of the following general structures: $(EO)_x(PO)_y(EO)_x$ and $(PO)_y(EO)_x(PO)_y$, where x is in the approximate range 2-128 and y is in the approximate range 16-67.

5. The method of claim 4, wherein the chemical additive is chosen from among the following: Pluronic L81, Pluronic L62, Pluronic L64, and Pluronic 25R2.

6. The method of claim 1, wherein the diffuser is a perforated hose made from polymeric or elastomeric material.

7. The method of claim 1, further comprising the step of preconditioning the diffuser by soaking or bubbling it in fresh or salt water before coating it.

8. The method of claim 1, further comprising the steps of operating the diffuser in water followed by recoating the diffuser with a chemical additive having bubble coalescence retardation properties.

9. A method for increasing the rise time of air bubbles emitted from a diffuser in water for the purpose of suppressing noise in a marine seismic survey, said method comprising the step of mixing a chemical additive in with the air within the diffuser before the bubbles are emitted, said chemical additive having bubble coalescence retardation properties or wetting agent properties or both.

10. The method of claim 9 comprising the additional step of atomizing the chemical additive.

11. The method of claim 9, wherein the chemical additive is chosen from among the following: n-propanol, 2-ethyl-1-hexanol, octanol, Exxal-8, Exxal-9, Exxal-13, and sodium dodecyl sulfate.

12. The method of claim 9, wherein the chemical additive is a poly(oxyalkylene) block copolymer composed of ethylene oxide (EO) and propylene oxide (PO) blocks having any of the following general structures: $(EO)_x(PO)_y(EO)_x$ and $(PO)_y(EO)_x(PO)_y$, where x is in the approximate range 2-128 and y is in the approximate range 16-67.

13. The method of claim 12, wherein the chemical additive is chosen from among the following: Pluronic L81, Pluronic L62, Pluronic L64, and Pluronic 25R2.

14. A method for increasing the rise time of air bubbles emitted from a diffuser in water for the purpose of suppressing noise in a marine seismic survey, said method comprising the step of injecting a chemical additive into the water in the region where the bubbles are emitted from the diffuser, said chemical additive having bubble coalescence retardation properties.

15. The method of claim 14, wherein the chemical additive is chosen from among the following: n-propanol, 2-ethyl-1-hexanol, octanol, Exxal-8, Exxal-9, Exxal-13, and sodium dodecyl sulfate.

16. A method for increasing the rise time of air bubbles emitted from a diffuser in water for the purpose of suppressing noise in a marine seismic survey, said method comprising the step of injecting a chemical additive into the water in the region where the bubbles are emitted from the diffuser, said chemical additive having wetting agent properties.

17. An apparatus for creating a bubble layer in water, comprising:

a) a bubble diffuser tube having small openings through which compressed air can be emitted, one end of said diffuser tube being closed, and the other end forking into a Y-conduit, said Y-conduit having a first Y-tube and a second Y-tube, said second Y-tube being adapted for connecting to an air compressor; and

b) an inner tube having a closed end inserted closed end first through the end of the first Y-tube and on into the bubble diffuser tube, said inner tube extending through an opening in an air-tight seal placed at the end of the first Y-tube and being adapted for connecting outside the first Y-tube to the output end of a pump.

18. The apparatus of claim 16, further comprising a pump connected at its output end to the end of the inner tube extending beyond the first Y-tube and connected at its input end to a holding tank suitable for holding a chemical additive having bubble coalescence retardation properties.

19. A method for increasing the rise time of air bubbles emitted from a diffuser in water for the purpose of suppressing noise in a marine seismic survey, said method comprising mixing a chemical additive having wetting agent properties into the diffuser during fabrication.

20. The method of claim 19, wherein the diffuser is a perforated rubber and linear low density polyethylene (LLDPE) hose and the additive is introduced in pellets comprised of Pluronic L81 blended into LLDPE, Polyvel VF-150 fatty glyceride wetting agent concentrate, or Polyvel VW-351 functionalized silicone wetting agent concentrate.